ENDOGENOUS GROWTH, DOWNWARD WAGE RIGIDITY AND OPTIMAL INFLATION

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The views expressed in this paper are those of the authors and do not necessarily represent those of the ECB or the IMF
Motivation

Standard New-Keynesian Models feature:

▶ Small welfare costs of business cycle fluctuations
▶ Monetary policy invariance hypothesis
▶ Optimal inflation target in a range between zero and 2%

We develop a New-Keynesian model:

▶ Endogenous growth via R&D
▶ Search and matching unemployment
▶ Downward wage rigidity

Reconcile Friedman (1968) and Tobin (1972) on the optimal rate of inflation
STYLIZED FACTS: OUTPUT HYSTERESIS AND DOWNWARD WAGE RIGIDITY

Sources: EA data from ECB’s AWM database.

Sources: Dickens et. al. 2007, based on international micro survey data for 8 EA and 3 EU countries, as well as CH, NO, UK, US prior to 2003
Summary of the Results

Key Features and Implications

F.1 Asymmetric business cycle and hysteresis effects on output/unemployment

F.2 Long-run trade-off between growth/unemployment and inflation

F.3 Consumption-equivalent welfare losses are a multiple of those associated with standard models

I.1 Inflation targeting: the optimal inflation rate is in excess of 2% and balances the welfare trade-off between price distortions and output hysteresis

I.2 Price-level targeting or a Taylor-rule responding to unemployment lead to lower welfare losses and would call for a lower optimal inflation target
KEY MECHANISMS AT PLAY

▶ DWR leads to asymmetric and larger effects on output and unemployment

▶ Endogenous growth: temporary shocks generate permanent effects on TFP and output via lower profits and R&D investment

▶ Higher real wages and weaker profitability delay the matching process resulting in higher unemployment duration

Figure: IRFs to a positive and negative demand shock (risk premium) between exogenous and endogenous with DWR model
Our model features a non-vertical Phillips curve for low inflation target rates.

The flattening of the long-run Phillips curve depends on macro volatility and growth.
WELFARE TRADE-OFF AND OPTIMAL INFLATION TARGET

FIGURE: Welfare losses from exogenous and endogenous growth models

Note: Panel (a) and Panel (b) show consumption-equivalent (CE) welfare losses for different inflation targets in models with exogenous and endogenous growth, respectively.
Endogenous growth, DWR and ZLB

- Welfare losses at the ZLB remain significantly lower in exog. growth models
- As in other papers (Coibion et al, Amano and Gnocchi), DWR reduces the likelihood of ZLB
- In our model, the interaction of ZLB and DWR calls for higher $\pi^*$

**Table: Optimal $\pi$ and welfare at the zero lower bound**

<table>
<thead>
<tr>
<th>Model variation</th>
<th>Optimal $\pi^*$</th>
<th>Welfare Loss at $\pi = \pi^*$</th>
<th>Frequency at $\pi = 1.8$</th>
<th>DWR</th>
<th>ZLB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exog. growth + SAM</td>
<td>0.00</td>
<td>0.56</td>
<td>0.70</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Exog. growth with ZLB</td>
<td>1.72</td>
<td>0.84</td>
<td>0.84</td>
<td>0.00</td>
<td>0.08</td>
</tr>
<tr>
<td>Exog. growth with ZLB &amp; DWR</td>
<td>3.24</td>
<td>1.22</td>
<td>1.39</td>
<td>0.20</td>
<td>0.04</td>
</tr>
<tr>
<td>Endog. growth + SAM</td>
<td>0.00</td>
<td>2.16</td>
<td>2.53</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>Endog. growth with ZLB</td>
<td>2.30</td>
<td>3.20</td>
<td>3.27</td>
<td>0.00</td>
<td>0.08</td>
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<tr>
<td>Endog. growth with ZLB &amp; DWR</td>
<td>3.86</td>
<td>4.42</td>
<td>6.40</td>
<td>0.22</td>
<td>0.05</td>
</tr>
<tr>
<td>Baseline</td>
<td>3.76</td>
<td>4.34</td>
<td>6.05</td>
<td>0.22</td>
<td>0.00</td>
</tr>
</tbody>
</table>
## Alternative Monetary Policy Strategies

- Lower welfare losses from PLT or a Taylor rule responding to $u_t$
- The optimal inflation target is lower and equal to 0.95% and 2.5%, respectively
- PLT captures history dependence of shocks and hysteresis effects in our model
- The Taylor rule responding to $u_t$ captures asymmetric business cycles in our model embedded in the unemployment rate

<table>
<thead>
<tr>
<th>Model variation</th>
<th>Optimal</th>
<th>Welfare Loss at</th>
<th>$\Delta$ Loss</th>
<th>Statistics at $\pi = 1.8$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\pi^*$</td>
<td>$\pi = \pi^*$</td>
<td>$\pi = 1.8$</td>
<td>$\pi^* - 1.8$</td>
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<tr>
<td><strong>Baseline calibration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.76</td>
<td>4.34</td>
<td>6.05</td>
<td>-1.72</td>
</tr>
<tr>
<td><strong>Alternative policy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Price level targeting</td>
<td>0.95</td>
<td>1.03</td>
<td>1.16</td>
<td>-0.13</td>
</tr>
<tr>
<td>Taylor rule with $u_t$</td>
<td>2.49</td>
<td>3.09</td>
<td>3.23</td>
<td>-0.14</td>
</tr>
</tbody>
</table>
CONCLUDING REMARKS

Propose a NK model with (a) endogenous growth, (b) search and matching unemployment and (c) downward wage rigidity

- Monetary policy invariance hypothesis is violated (non-vertical PC)
- Welfare costs of business cycles are large, asymmetric and persistent.

There is a trade-off between welfare costs of price distortions and output hysteresis. In our model, this trade-off calls for an optimal inflation target above 2%

- A higher inflation target is not a tactical consideration related to ELB.

Make-up monetary policy strategies do better in terms of welfare and call for a lower optimal inflation target. Better suited to deal with asymmetry and hysteresis

Caveats: the analysis does not account for important issues such as de-anchoring of inflation expectations, central bank credibility and transition dynamics
Robustness Analysis and Key Drivers

Looking at factors making DWR less binding, price distortions more costly or output hysteresis lower:

- Long-term productivity growth and shocks’ assumptions
- Degree of nominal rigidities and Calvo’s pricing
- R&D process

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<td>Model variation</td>
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<td>Baseline calibration</td>
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</tbody>
</table>

**Parameter assumptions**

- Higher growth ($g = 1.6$) 3.44 4.31
- Higher wage rigidity 3.52 4.41
- Higher price rigidity 3.16 5.67
- Calvo pricing 3.30 4.75
- Lower OBC on DWR ($-1.0\%$) 3.00 3.72
- Lower R&D diffusion 3.50 3.40

**Shock assumptions**

- Small risk premium shocks ($\sigma = 0.15$) 3.06 3.05
- Small technology shocks ($\sigma = 0.4$) 3.68 4.12
FULL PRESENTATION:

ENDOGENOUS GROWTH, DOWNWARD WAGE RIGIDITY AND OPTIMAL INFLATION